

Homework 3

Robotics 2020 - ShanghaiTech University

1 Introduction

Jiawei Hou, Yizheng Zhang, Prof. Andre Rosendo and Prof. Sören Schwertfeger together are working on a Mobile Manipulation Tutorial (MoManTu). The tutorial is submitted to a journal already. Nevertheless, it is not completely finished yet and also may still contain small bugs.

The tutorial is about using a mobile manipulation robot to solve a simple task - going to a room, grasping a water bottle and bringing it somewhere. In this homework you will play with the simulation part of the tutorial. In a later homework you will, in your project group, first develop something new about the system, test it in simulation, but then also employ it on the real robots.

For this homework your tasks are: Follow the whole tutorial, setup the system on your laptop (so do not use the docker version), play with the simulated robot and then change the virtual environment, map your new environment and then run the demo in your new environment.

2 MoManTu

The first task is to read the MoManTu. It comes in two parts. A shorter introduction (to be printed in the journal) and a longer, detailed tutorial. They are not published yet, so please do not share them. There is also a website and github repos for the tutorial:

- <https://momantu.github.io/>
- https://robotics.shanghaitech.edu.cn/static/robotics2020/MoManTu_Intro.pdf
- <https://robotics.shanghaitech.edu.cn/static/robotics2020/MoManTu.pdf>

Follow the tutorial and run the simulated robot demo.

2.1 Feedback 10%

One of your tasks for this homework is to give feedback on the tutorial. Please mention everything that is unclear, not working, not good, English problems, etc. that you encounter. We will use your feedback to improve the tutorial. So please write a *feedback.txt* file and please mention at least 5 items.

3 Create your own world 25%

Your task is now to create your own virtual environment. The detailed version of the tutorial should give you all the pointers you need - if not please feedback in the file. The requirement is, that the new world has to be created from scratch by you. Please only use models that were originally installed by gazebo. In the end the demo should run in your world, so it has to have the right elements (bottle on table, another table with QR code). Both things (bottle and QR) should be reasonably far away from each other - e.g. different rooms.

Put the *.world* file in your hw repo.

4 Create a map of your own world 25%

In order to run the MoManTu demo with your world you need to create a map of your world, such that the system can localize itself. Follow the MoManTu to create the map using cartographer. Put the map files *.pgm* and *.yaml* in the homework repo.

5 Demo the running MoManTu 40%

You then should be able to run the demo. It actually depends on (semantic) information to be present to know roughly where to search for the bottle and the AprilTag. Typically, in robotics, a semantic map would be used for that (that has the information about what rooms are given what name, for example). In MoManTu this information is provided in the FlexB module, which is the state machine. So in order to run the demo with your map you will need to update the goal coordinates for the navigation in FlexB.

In the week Oct 13 - 16 you need to show the running MoManTu demo to Prof. Schwertfeger. With your map and your environment, the demo should run smoothly. The demo itself will not take long. A good time for the demo is after the lecture that Tuesday or Thursday. Maybe there will be several demos running in parallel, and Prof. just need to take a brief look at each.

5.1 Academic Honesty

This is a homework - it is not group work! Everybody has to do it by themselves. The world you create has to be uniquely created by yourself from scratch.

It is allowed that students show each other their world and the created map.

6 Submission

Your submission consists of the following 4 files, located in a folder called "hw3" in your hw gitlab repo.

The following files are important:

- "feedback.txt"
- "something.world" created by you!
- "something.pgm" created by you!
- "something.yaml" created by you!

Also do not forget to show your demo in week Oct 13 - 16!